# THE STATUS AND MANAGEMENT OF THE BATHURST CARIBOU HERD, NORTHWEST TERRITORIES, CANADA

Northwest Territories Resources, Wildlife & Economic Development

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# THE STATUS AND MANAGEMENT OF THE BATHURST CARIBOU HERD, NORTHWEST TERRITORIES, CANADA

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This report was developed from the Draft Bathurst Caribou Management Plan, therefore, the management plan report format has been used rather than that of the Wildlife Management Division's File Report series.

# ABSTRACT

This report outlines the goals and objectives used by the Department of Renewable Resources for management of the Bathurst caribou herd during the past 10 years. The report also summarizes available data on ecology, discusses various uses of the herd, addresses potential impacts of industrial and recreational development, and describes management options for achieving goals and objectives. In 1988, a draft Bathurst Caribou Management Plan was widely circulated among interest groups and the public, and public meetings were held throughout the Bathurst caribou range to discuss management options. This draft plan and comments received resulted in the management program described in this report.

The Bathurst caribou herd is the largest in the NWT and is accessible to more people than other NWT herds. Bathurst caribou presently occupy a range of approximately 250,000 km$^2$. In 1990, herd size was estimated at 352,000 caribou age one year and older. At the present time the herd is at a density of 2 caribou/km$^2$ over the entire range.

The Bathurst herd and range appear to be in very good condition. Recruitment has been high for several years and hunter kill has been relatively low. Hunter harvest is a major source of mortality for the Bathurst herd. General Hunting License holders make up the bulk of the hunting population, followed by Resident, Non-resident and Non-resident alien hunters. The total harvest of Bathurst caribou (including commerical harvest) is estimated to be between 14,500 and 18,500. It is felt that the herd can sustain this level of harvest. The wolf is the only major predator of barren-ground caribou and is one of the main factors affecting natural mortality rates and, therefore, population growth. Disease and parasitism are believed to be relatively unimportant at this time, although insect harassment may contirbute to poorer fall condition and possibly reduced fertility. Inter- and intra-specific competition do not appear to significantly influence population growth. No data exist to suggest that weather has been a significant or direct cause of mortality on the Bathurst range. Fire is a significant factor affecting the distribution of plant species and succession of the forests on the Bathurst range, but fire has had no detectable affect on caribou productivity. Through their influence on range quality and, therefore, caribou distribution, forest fires may affect the availability of caribou to some users.

Industrial activities on the Bathurst range include mine sites, mineral exploration camps, winter access roads and air strips. Individually, most of the potential and proposed developments are expected to have limited impact on the herd; however, development needs to be addressed on a regional and cumulative basis.

A main management objective for the Bathurst herd is to maintain a population level high enough to sustain a harvest of at least 16,000 annually. A population of between 300,000 and 600,000 has been identified as the range which will meet this objective. The total allowable harvest based on current informtion and the 1990 population estimate is approximately 23,000 caribou. A calving ground survey to estimate the number of caribou in the herd is recommended for 1996.

It is intended that this report be the basis for future discussions on the management of the Bathurst caribou herd. It is recommended that a management plan for the Bathurst herd be developed in consultation with all stake-holders following the calving ground survey in 1996.

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# INTRODUCTION

Barren-ground caribou (*Rangifer tarandus groenlandicus*) are a significant resource to the people of the Northwest Territories (NWT). Caribou hunting is an important component of Inuit, Dene and Metis cultures and many NWT residents choose to maintain a lifestyle largely dependent on caribou and other renewable resources. In addition, other Canadians and people around the world derive satisfaction from the knowledge that there are healthy, free ranging herds of barren-ground caribou. The caribou is recognized worldwide as part of Canada's abundant natural resources.

The Bathurst caribou herd is the largest herd in the NWT and is accessible to more people than other NWT herds. The Bathurst herd, therefore, has the potential to provide benefits to a large number and a wide variety of users.

This report outlines the goals and objectives that the NWT Department of Renewable Resources has been using for the management of the herd, summarizes available data on the ecology of the herd, discusses the various users of the herd, addresses the potential impacts of industrial and recreational development, and describes management strategies for achieving the goals and objectives.

# ECOLOGY

An understanding of the basic ecology of caribou in the Bathurst herd is essential to the development of management strategies and to the effective management of the species. This section provides current information on the ecology of the Bathurst caribou herd.

## Taxonomy and Description

Caribou and reindeer belong to the deer family (Cervidae) which also includes deer (*Odocoileus* sp.), elk (*Cervus canadensis*), and moose (*Alces alces*). The barren-ground caribou are the most abundant of the four indigenous subspecies of caribou in the NWT. The other three subspecies are: Peary caribou (*R. t. pearyi*), which inhabit the Arctic Islands; woodland caribou (*R. t. caribou*), found in the boreal forest and Mackenzie Mountain regions of the western NWT; and Grant's caribou (*R. t. granti*), which range from the Porcupine Mountains in Alaska into the northwestern NWT. The reindeer (*R. t. tarandus*) is a semi-domesticated, Eurasian subspecies, introduced near Tuktoyaktuk and to the Belcher Islands.

Barren-ground caribou are intermediate in size between the smaller Peary caribou and the larger woodland caribou. Adult males (3 years and older) stand about 110 cm (43 in) high at the shoulder and, in winter, weigh approximately 110 kg (240 lb). Adult females (3 years and older) average 104 cm (41 in) in height and weigh about 80 kg (175 lb) (Banfield 1974). Both sexes grow antlers, a characteristic unique to caribou within the deer family. Mature males shed their antlers in November after the October rut, while younger males may retain them until May. Pregnant females drop their antlers after calving in June. Calves of both sexes first begin to develop antlers at about 3 weeks of age and carry them until June of the following year (Graves 1980). Caribou antlers exhibit a great deal of variation. According to Banfield (1974), the antlers

of male caribou average 96 cm (38 in) in length, while those of females average 39 cm (15 in). Antler size is correlated with age for the first five years.

Coat colours vary over the course of the year. In winter the coats are a light brown colour, while in late fall they show the greatest degree of contrast. At this time, bulls have dark chocolate coloured bodies, muzzles, and legs, with prominent, white manes on their throats. Females are more uniformly dark and usually do not develop a mane. Calves are reddish at birth but begin to develop adult coloration over the summer.

## Distribution and Movement

The Bathurst herd is one of the five major barren-ground caribou herds found on the mainland NWT (Fig. 1). Each herd consists of a relatively cohesive group of caribou which moves between a large winter range and a small, relatively discrete, calving ground. The Bathurst herd was named after Bathurst Inlet, the area traditionally used for calving.

Bathurst caribou presently occupy a range of approximately 250,000 km$^2$ (Fig. 2). Within this range, the distribution and density of the herd varies, both throughout the year and among years. It has also been suggested that the size of the range increases and contracts with changing population size as with other herds (Bergerud et al. 1984, Heard and Calef 1986). The most frequently recorded wintering areas are found northwest of Yellowknife, north of the east end of Great Slave Lake, south of Great Bear Lake near Rae Lakes, south of Coronation Gulf Coast near Coppermine and north of Bathurst Inlet (Fig. 2).

Historically, the Bathurst calving ground is located around the south end of Bathurst Inlet. However, in some years, including most of the early 1980s, the area east of Bathurst Inlet may be used. Most cows (along with some yearlings and bulls) arrive on the Bathurst calving grounds by late May and early June. Most bulls, some yearlings, and non-pregnant females tend to lag behind during the spring migration and generally do not migrate as far as the calving ground. These animals usually join up with the cows and calves, once they have left the calving grounds. These mixed groups may form large post-calving aggregations in late June and July in response to insect harassment. In summer, Bathurst caribou may be found throughout the tundra portions of their range, as the caribou take advantage of the summer tundra vegetation. Large groups of both sexes occur near the treeline during the rut in October, after which the cows and bulls segregate. Most years, both sexes return to the boreal forest after the rut with bulls generally moving deeper into the forest than cows and yearlings.

The precise movements of caribou are unpredictable. Only large scale movements such as the movement towards the calving ground in May and June and the movement southward in the fall can be predicted with any degree of certainty. Even the timing and route of these movements vary. During the remainder of the year movements are extremely variable and an area where there were thousands of caribou one year may not have a single animal the next. With few barriers to their movement, with the possible exception of the large lakes such as Contwoyto and Point lakes in the fall, there are no specific migration corridors which are used each year.

Figure 1. Approximate range of mainland barren-ground caribou herds in the Northwest Territories.

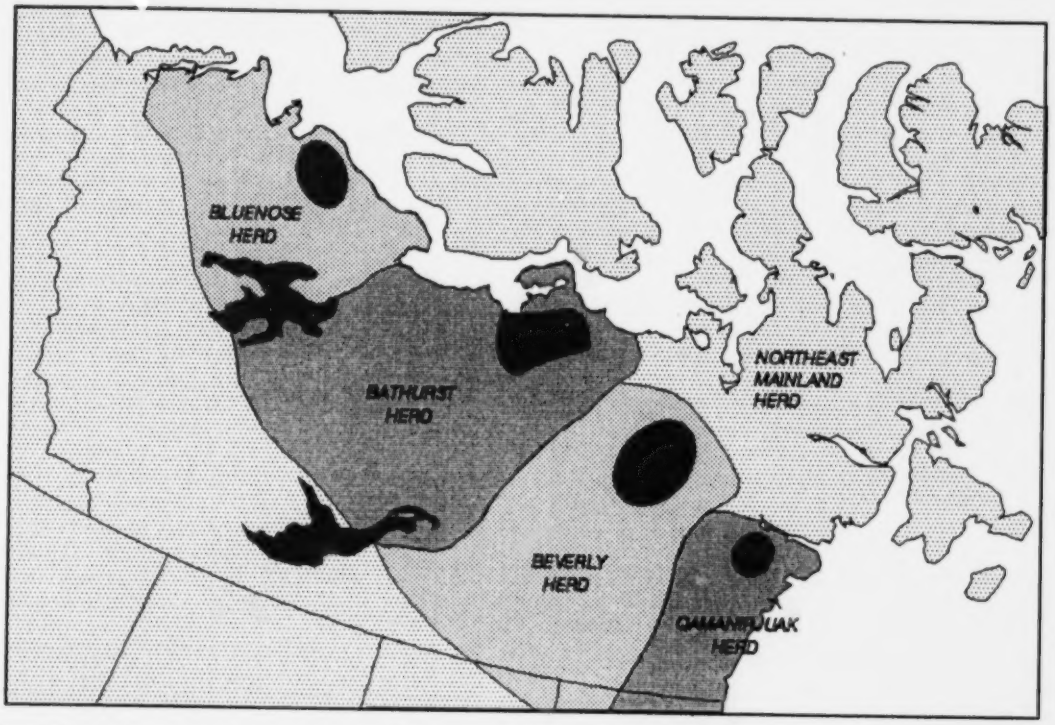
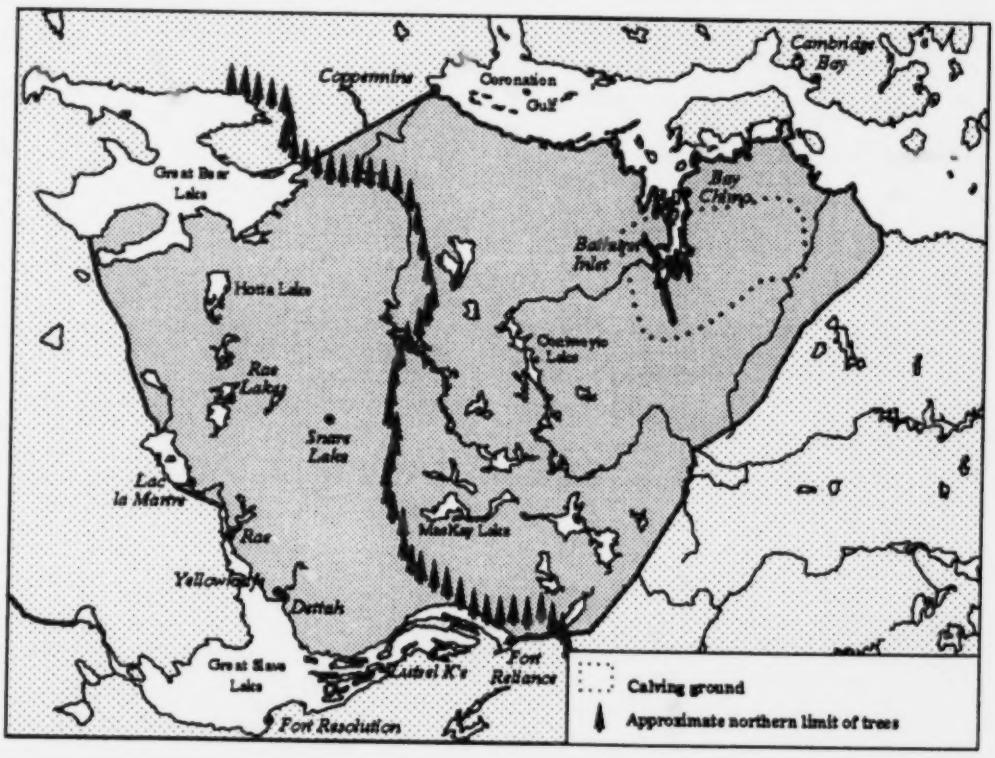



Figure 2. Bathurst caribou range and calving ground.



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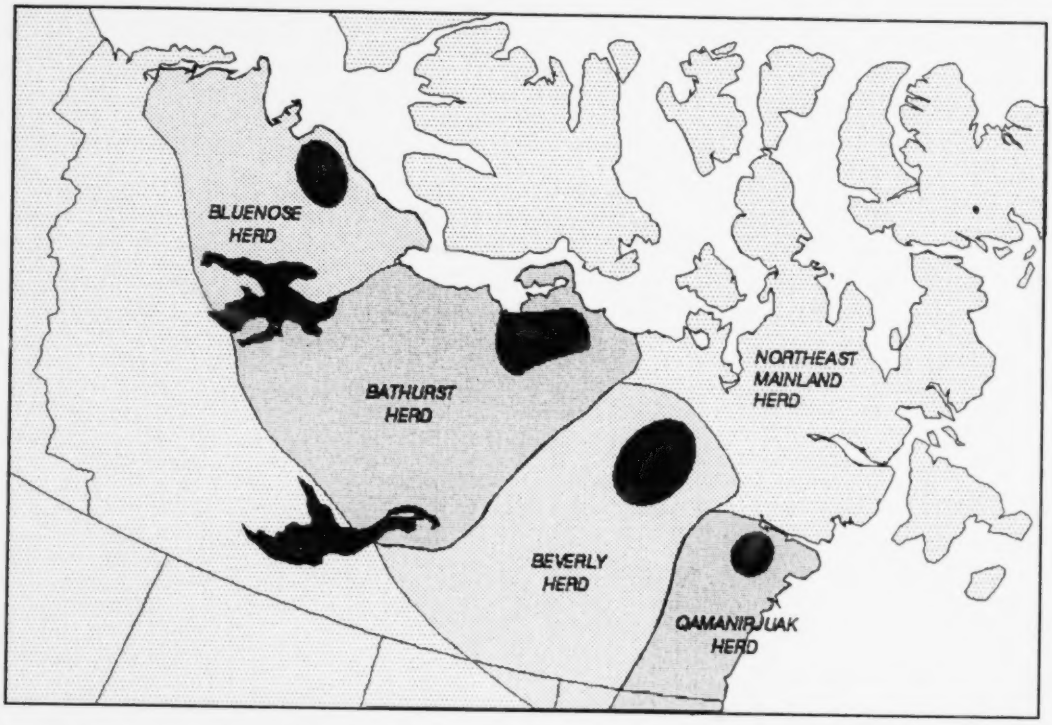


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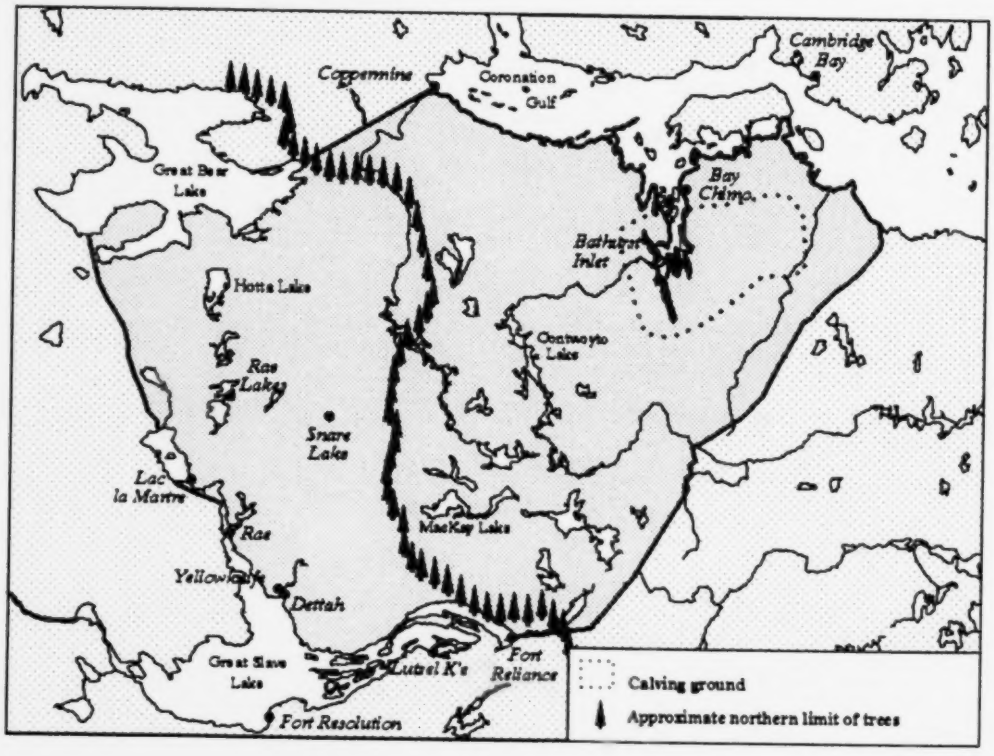


An annual mass movement along definable routes, which is often brought to mind by the term migration, is rarely observed. Only in the spring, when caribou move out onto the tundra, does there appear to be an intense directional movement of animals.

## Habitat

The range of the Bathurst caribou herd encompasses a wide variety of habitat types. Their annual movements take them from dense boreal forests to sedge meadow and lichen upland tundra habitats. Detailed descriptions of the geology and plant life of these two biomes are presented in Kelsall (1968), Rowe (1972), Kelsall et al. (1977), Thompson et al. (1978), and Fleck and Gunn (1982).

Habitat selection by caribou is complex and not well understood, as at any one time caribou can be found in a number of habitat types. The selection of habitat appears to be related to a complex array of factors affecting availability of food, ease of travel, relief from insects, and predation. For example, snow characteristics influence the selection of winter habitat (Pruitt 1959, Henshaw 1968, Bergerud and Nolan 1980, Lent and Knutsen 1971). Wide open areas, such as lakes and burned areas, are used as escape terrain and resting sites (Kelsall 1968, Miller 1980). In summer, eskers and other high ground are selected to provide relief from insects.

## Diet

By understanding the forage requirements of caribou at different times of the year, it is possible to estimate the capability of the range to support caribou, and determine whether the range is being damaged, either by the caribou or by human activity.

Studies by Thomas et al. (1984) indicate that, in winter, caribou select forage with high digestibility or high protein levels (e.g., certain lichen species and the green parts of sedges), and avoid evergreens, shrubs with waxy leaves [e.g., Labrador tea (*Ledum* sp.), Crowberry (*Empetrum nigrum*), blueberry (*Vaccinium* sp.), bearberry (*Arctostaphylos* sp.)], dead leaves, and woody tissues, because they are difficult to digest.

Most of the winter diet consists of lichens. However, because lichens alone cannot provide adequate protein, caribou supplement their diet with sedges (*Carex* sp.) and horsetails (*Equisetum* sp.) in early winter, and alder (*Alnus* sp.), birch (*Betula* sp.), and willow (*Salix* sp.) in late winter (Miller 1976).

The diet of caribou in the spring and on the calving grounds also depends on forage availability. Jingfors et al. (1982) found that lichen uplands were the first areas to lose snowcover, and that fruticose lichens in these areas were important until new plant growth emerged. On the Bathurst calving grounds, willows, dwarf birch, green alder (*Alnus crispa*), and cottongrass (*Eriophorum vaginatum*) are common and are likely utilized as new growth emerges (Fleck and Gunn 1982).

During the summer, caribou range widely over the tundra and their diet is variable. Lichens become less important and are replaced with a variety of grasses, sedges, forbs, and other plants. Caribou tend to select new sprouts and buds as well as flowers; foods which are rich in minerals and protein (Thompson and McCourt 1981). The consumption of grasses and sedges diminishes as these plants mature

and become less digestible (Kelsall 1968). By late summer the leaves of deciduous shrubs such as willows, dwarf birch, and bearberry form the bulk of the caribou's diet (Skoog 1968).

In the fall, grasses and sedges, which are ignored during late summer, are consumed because proteins are retained in the leaves longer than other plants. Birch and willow leaves are still important. Mushrooms are also selected at this time of year (Kelsall 1968, Skoog 1968). The summer and fall diet results in dramatic weight gains. During this period, adult males and females may increase their weights by 20% and 10%, respectively.

## Calving Grounds

The fidelity of caribou to their calving areas suggests the caribou are selecting the area for some habitat characteristics. However, exactly what the important habitat characteristics are has not been determined, but a number of possible explanations have been proposed.

Roby (1980) suggested that the location of the calving areas of the Central Arctic herd in Alaska is related to predator avoidance, as there are low numbers of wolves and bears in the area selected. This may also be the situation on the Bathurst calving grounds, as there seems to be relatively low numbers of wolves, wolf dens, and bears in that area (Fleck and Gunn 1982, Heard and Williams 1992).

Fleck and Gunn (1982) found that the topography of the Beverly calving grounds was more varied than that of surrounding areas. They suggested that this might lead to a more diverse plant community, but this was not investigated. Studies on feeding site selection by caribou and reindeer (La Pierre and Lent 1977, Bergerud 1974a, Skogland 1978) suggest increased topographical relief may create more favourable feeding opportunities when the ground is snow covered.

The location of the Bathurst calving ground has remained around or just east of Bathurst Inlet since it was first described in 1950 (Kelsall 1953). Archaeological evidence suggests that the caribou have calved in this area for the past 6000 years, since the glaciers retreated from the area after the last ice age (Fleck and Gunn 1982). As the environmental conditions on the calving area have changed since then, it is possible that the original factor, or factors, influencing the location of the calving grounds may no longer exist. In addition, the selection of calving grounds may be a result of a combination of the factors listed above.

The fact that the caribou return to the area year after year warrants a conservative approach to the management of the calving grounds, even without a clear understanding of why the areas are used.

## Population Dynamics

Bathurst caribou exist within a dynamic and changing environment. Within this environment, factors such as predation, hunting, disease, parasitism, insect harassment, weather, variation in habitat suitability and availability, and man-caused disturbances affect the physical condition, productivity, recruitment, mortality and, ultimately, herd composition and size. The demographic and behavioral impacts of these factors vary in both space and time. The following discussions provide our current understanding of the population dynamics of the Bathurst herd, how the information is or can be

obtained, and how the information can be used by those involved in the management of the herd.

## Herd Size

A decline in caribou numbers occurred in the late 1970s and was followed by a substantial recovery after 1980 (Table 1, Fig. 3). In 1984 there were an estimated 384,000 caribou one year old and older in the Bathurst herd and an estimated 486,000 caribou one year old and older in 1986. Herd size in 1990 was estimated at 352,000 caribou one year old and older.

The very large increase (280%) in herd size observed between 1982 (174,000) and 1986 (486,000) was likely due to a combination of increased recruitment and immigration. It is possible that caribou from the Queen Maud Gulf area (northeast Mainland herd), where caribou inhabit the tundra year-round, may have been included in the Bathurst calving ground survey. Such changes may represent real growth to an individual herd, however, managers and resource users must recognize that the immigration of animals from one herd will result in the reduction of the size of an adjacent herd. Because recruitment between 1986 and 1990 was high and hunter kill was relatively low, the 1986-1990 decline was probably less severe than the estimates indicate.

Population estimates for caribou in the NWT have involved both visual and photographic techniques, the latter being the most recent advancement. Photography now provides the primary data for estimating population size. Details of these methods and their development are documented by Heard (1985).

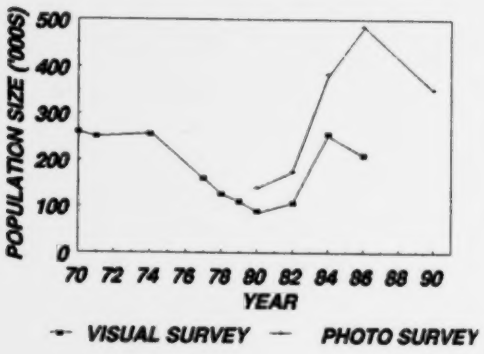
Herd size and changes in herd size are the ultimate indicators of the status of the herd. This information is used by managers, in combination with other data, to determine the appropriate management requirements for the herd.

Table 1. Population estimates for the Bathurst caribou herd and adjacent herds in the mainland NWT.

| | Total Population (000s) | | | |
|---|---|---|---|---|
| Year | Bathurst | Bluenose | Beverly | Qamanir-juaq |
| 1977 | 160 V (62 V) | 42 V | - | 44 V |
| 1978 | 127 V (49 V) | 27 V | 130 V | - |
| 1979 | 100-120 V | 35 V | - | - |
| 1980 | 140 V (89 V) | 58 V | 105 V | 39 V (13 V) |
| 1981 | - | 38 V | - | - |
| 1982 | 174 P (107 V) | - | 195 P (140 V) | 180 V |
| 1983 | - | 65 P (34 V) | - | 230 P (120 V) |
| 1984 | 384 P (255 V) | - | 335 P (145 V) | - |
| 1985 | - | - | - | 320 P |
| 1986 | 486 P (210 V) | 98 P | - | 320 P |
| 1987 | - | 115 P | 94 V | - |
| 1988 | - | - | 190 P (51 V) | 221 P (95 V) |
| 1989 | - | - | - | - |
| 1990 | 352 P | - | - | - |
| 1991 | - | - | - | - |

V = Visual survey
P = Photographic survey

Figure 3. Population estimates for the Bathurst herd, 1970-1990.




Herd Composition

The adult sex ratio is difficult to determine because the herd is separated by age and sex throughout most of the year. The only time when all ages and sexes are fairly well mixed is in the fall during the rut. At this time, the animals are sparsely distributed and the weather is predictably poor. Obtaining an estimate of the adult sex ratio under these conditions is cost prohibitive. Therefore, biologists normally use the North American mean of 36% males and 64% females (Bergerud 1980).

No information is available on the age structure of the Bathurst herd. This data would be difficult and expensive to obtain, as it would require a large random sample of the herd.

The adult sex ratio is used in calculating the total population size from calving ground surveys. It is also used to calculate the number of animals which can be harvested from the herd. If age structure data were available they would also be used in these calculations.

Reproductive Characteristics

Studies of Bathurst caribou in 1990 and 1991 found that females did not breed until 2.5 years of age, when approximately 38% of the cows became pregnant. The conception rate for 3.5 year olds was 65% (Case, upubl. data). Population estimates for the Bathurst herd have typically assumed a mean pregnancy rate of 72% among females older than one year (Heard 1985). This figure was derived from data describing age structure and pregnancy rates of Qamanirjuaq caribou in the late 1960s (Parker 1972, Dauphine 1976). Thomas et al. (1986) determined the pregnancy rates in the Beverly herd from 1981 to 1986. The data suggest age specific pregnancy rates can be as high as 12% for 1.5 year olds and 75% for 2.5 year olds. Bergerud (1980) suggested that nutrition in the first summer of life is probably important in determining the rate at which calves reach reproductive age. This factor may apply to other age classes as well and contribute to the observed annual variations in pregnancy rate.

This data is used in calculating the total population size from calving ground estimates. It is also important in the understanding of calf survival and the potential for the herd to increase.

Recruitment

The term *recruitment* refers to the number of caribou calves reaching one year of age. Because this figure is difficult to obtain, a recruitment index is usually used. For caribou, the proportion of calves (9-10 months old) in the herd in March or April is used (# of calves /[# of calves + # of adults]) (Table 2). Assuming that the variation in mortality among

caribou over one year of age is relatively constant, this recruitment index should approximate the proportion of animals entering the breeding population.

Recruitment estimates for the Bathurst herd have been determined annually since 1984 (Table 2). This information is used to monitor the status of the herd between population estimates. Recruitment estimates provide an indicator of herd health and the potential for herd growth.

These estimates are also important in calculating the number of animals which can be harvested from the herd, as they indicate what is coming into the herd and, therefore, what can be removed.

Natural Mortality

Estimates of natural mortality require several years of data from a large sample of radio-collared animals. Such data do not exist for the Bathurst herd. However, recent data from studies on barren-ground caribou in Alaska (which, like the Bathurst, are subject to both wolf predation and human harvest), indicate that natural mortality was 8% for adult females and 16% for adult males, for an overall mean of 11% for the entire herd (Davis and Valkenburg 1985). Bergerud (1980) estimated a mean natural mortality figure of 10% for eight North American herds. Graf and Heard (1990) estimated the average adult natural mortality rate for the Beverly and Qamanirjuaq herds to be 8.4%, based on observed calf recruitment and the regression formula derived by Bergerud (1983).

Estimates of natural mortality are important in calculating the number of animals which can be harvested from the herd, as they indicate what is being removed from the herd naturally and, therefore, what should be available to hunters without causing the herd to decline.

Table 2. Spring composition and recruitment from the Bathurst caribou herd, 1979-1994 (NWT Dept. of Renewable Resources files)

| Year | Spring Composition (Calves/100 cows[1]) | Recruitment Index (Percent of Calves in population[2]) |
|---|---|---|
| 1979 | 21 | 12 |
| 1980 | - | - |
| 1981 | - | - |
| 1982 | - | - |
| 1983 | - | - |
| 1984 | 22 | 12 |
| 1985 | 30 | 16 |
| 1986 | 48-61 | 22-28 |
| 1987 | 37 | 19 |
| 1988 | 58 | 26 |
| 1989 | 36 | 18 |
| 1990 | 33 | 16 |
| 1991 | 46 | 22 |
| 1992 | 30 | 16 |
| 1993 | 46 | 22 |
| 1994 | 29 | 15 |

[1] Calves are less than one year and cows refers to all females over 1 year.

[2] Assumes a sex ratio of 56 bulls:100 cows.

Predation

The wolf (*Canis lupus*) is the only major

predator of barren-ground caribou in the Northwest Territories (Banfield 1954, Kelsall 1968, Parker 1972), and is one of the main factors affecting natural mortality rates and, therefore, population growth. The grizzly bear (*Ursus arctos*) is believed to be only an infrequent predator of caribou in this area (Kelsall 1968)

Caribou comprise a significant portion of the winter and summer diets of the wolf (Table 3). Over 91% of wolf scats from three den sites on the Bathurst range contained caribou hair (Williams, unpubl. data) Williams (1990) studied wolves denning on the ranges of the Bluenose and Bathurst caribou herds, and found that they relied primarily on caribou throughout the summer. At one den site on the Bathurst range, wolves did not rely on alternate prey even when caribou were not available, resulting in the mortality of the pups.

Wolf predation is also the primary source of neonatal calf mortality in the Bathurst herd and wolves tend to select calves when they are available (Bergerud et al. 1984).

Although there are no abundance estimates for wolf populations in the NWT, there are believed to be between 1500 and 3000 wolves on the Bathurst range (Williams, unpubl. data). It is not known whether the number of wolves is increasing, stable or decreasing. The harvest of wolves increased between 1970 and 1991 (Fig. 4). This probably reflects an increase in the number of wolf hunters in the area, an increase in the value of wolf pelts, and the proximity of the caribou herds to settlements, rather than an increase in the wolf population.

Based on radio-cesium analysis, it is estimated that a wolf consumes 15-30 caribou/year, which is similar to the Alaskan estimates of 10-27 caribou/wolf/year (Stephenson and James 1982). Radio-cesium analysis appears to underestimate the consumption rate, suggesting that consumption rates are likely closer to the high end of the estimates. Therefore, wolves may be taking between 21,000 and 90,000 (6% to 25% of the 1990 population estimate) Bathurst caribou annually. Splitting the difference of these figures suggests that 55,500 caribou are taken annually, or 16% of the 1990 population estimate. If calves comprise 25% of the kill, wolf-caused adult mortality would approximate the 10% natural adult mortality figure suggested by Bergerud (1980).

Predation has a major impact on natural mortality rates and, therefore, recruitment, both of which are used in calculating the number of animals which can be harvested from the herd. An increased understanding of wolf predation will help explain changes in recruitment rates and population size.

Hunter Harvest

The harvest by resident hunters is determined annually by the Resident Hunter Harvest Questionnaire. The non-resident and non-resident alien harvest is reported annually by the outfitters.

The GHL harvests for Coppermine, Cambridge Bay, Bay Chimo/Bathurst, Fort Rae/Edzo, Rae Lakes, Lac la Martre and Snare Lake were estimated from harvest studies using community fieldworkers and monthly interviews of hunters (Gunn et al. 1986, NWT Dept. of Renewable Resources files).

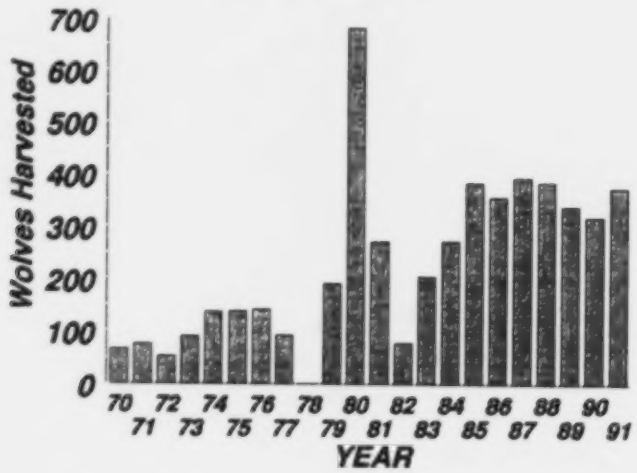
An understanding of the harvest, including age, sex, location and number of caribou killed, is essential to understanding the population dynamics of the herd. The harvest is a significant source of

Table 3. Frequency of food items occurring in wolf scats from the Bathurst range in 1979 and 1982 (T.M. Williams unpubl. data).

| Prey species | Central Bathurst Dens[1] | | Bathurst Calving Ground Den[2] |
|---|---|---|---|
| | 1979 # of scats (%) | 1982 # of scats (%) | 1982 # of scats (%) |
| Caribou | 95 (90) | 118 (91) | 42[3] (91) |
| Small mammals[4] | 33 (31) | 80 (62) | 23 (50) |
| Birds/bird eggs | 7 ( 7) | 27 (21) | 3 ( 7) |
| Fish | 0 ( 0) | 6 ( 5) | 0 ( 0) |
| Muskox | 0 ( 0) | 0 ( 0) | 3 ( 7) |
| Number of scats | 105 | 129 | 46 |

[1] Occupied dens at Jolly Lake and Greenstockings Lake.
[2] Unoccupied den.
[3] Twenty-three contained adult hair and 19 contained calf hair.
[4] Includes beaver, muskrat, microtines, mustelids, hare, ground squirrel and arctic fox.

Figure 4. Wolf harvests on the Bathurst range, 1969/70 - 1990/91.



mortality that has been implicated in declines in herd size elsewhere (Bergerud 1974b). Accurate harvest data are required to evaluate causes of herd declines and to identify additional harvesting opportunities. Commercial harvesting can only be considered at low levels unless the other hunters' harvest levels are known.

The harvest of Bathurst caribou by GHL holders, residents, non-residents, and commercial hunters in the late 1980s was estimated to be 14,500 - 18,500. This is only a rough estimate as data on the GHL harvest has not been collected range wide in any given year. Upper harvest limit was obtained by summing the maximum recorded GHL harvest for communities known to access the Bathurst herd. The lower limit was obtained by summing the maximum GHL harvest observed for the eight communities which are on or border the Bathurst herd range (Fort Rae/Edzo, Yellowknife/Detah, Rae Lakes, Lac la Martre, Snare Lake, Bay Chimo/Bathurst Inlet, Cambridge Bay, Coppermine). Obviously the annual harvest will vary greatly from year to year but it is reasonable to expect it to be within the range of 14,500 to 18,500.

A harvest of 14,500 - 18,500 represents 4.1 - 5.3% of the 1990 population estimate for the Bathurst herd (352,000). It is felt that the Bathurst herd can sustain this level of harvest.

Disease and Parasitism

The extent to which disease and parasitism affect the Bathurst caribou is unknown, but they are believed to be relatively unimportant at this time. No large scale mortality of caribou on the mainland NWT has ever been linked to an epizootic disease outbreak or to extreme parasite loads. Of the various organisms known to infect barren-ground caribou, only three are thought to affect the productivity of the herd or have significance to human health.

Brucellosis, caused by *Brucella suis* (type 4), is an infectious bacterial disease of the reproductive tract of both wild animals and livestock, and is endemic to reindeer and caribou herds throughout the Arctic (Meyer 1966). It can result in spontaneous abortion late in pregnancy, pathological changes in the genital tract of males, lameness, and generally poor health in both newborns and adults (Dieterich 1980, Witter and O'Meara 1970). The disease can be transmitted to humans who come into close physical contact with infected caribou. Early symptoms are often general and can be mistaken for common illnesses such as flu. If not treated brucellosis can sometimes cause deafness and paralysis, and can be fatal (Jawetz et al. 1976). The incidence of brucellosis in the Bathurst herd is unknown, however, two infected caribou from this herd were found in the Coppermine area in 1980 and 1981 (Urquhart 1981). In practical terms, the type of brucellosis found in caribou (*Brucella suis* type 4) is different from the brucellosis found in bison (*Brucella abortus*), and the two species cannot infect each other.

The warble fly (*Oedemagena* sp.) and the nasal bot fly (*Cephenmyia* sp.) are the other two major parasites associated with all barren-ground caribou herds. Warble flies deposit eggs on caribou hides and the larvae subsequently burrow under the skin, where they develop during the following year. Larvae drop out during the following summer to

undergo pupation and metamorphosis. Nasal bot flies lay eggs in the nasal passages and throats of caribou where larvae develop. Hundreds of larvae from either, or both, species can infect one caribou (Dieterich 1980, Thomas et al. 1986). Such parasite loads are believed to represent a serious impairment to the health of infected animals and, although they do not normally cause direct mortality, they may increase the probability of death by other factors (Dieterich 1980).

Thomas et al. (1986) noted relatively high larval loads in young females 1.5 to 4.5 years of age with low body condition indices. This relationship was not observed in older females. Data from Davis et al. (1980) indicated that warble and bot flies may contribute to some calf mortality in Alaska. Kelsall (1953) also suggested that mortality of Bathurst calves and adults may occur as a result of flies. Parasitism by either fly can also result in weight loss or decreased weight gain, while warble flies reduce the economic value of hides, as emerging larvae leave holes in the hide.

Other parasites reported in barren-ground caribou include the tapeworms *Echinococcus granulosis*, *Taenia krabbei*, and *T. hydatigena*, and the protozoans *Besnoitia* sp. and *Sarcocystis* sp. (Dieterich 1980, Thomas et al. 1986). The rabies virus may also infect caribou. These parasites and the rabies virus do not contribute significantly to mortality.

Competition

Inter- and intra-specific competition do not appear to influence the population growth of the Bathurst herd at the present time. Barren-ground caribou from the Bathurst herd share their range with two other large herbivores. Muskoxen (*Ovibos moschatus*) occur at varied densities on all tundra portions of the Bathurst range. In winter the Bathurst herd may also share some forested portions of its range with moose. Differences in habitat use and food selection suggest that competition between muskoxen and caribou is minimal (Tener 1965, Russell et al. 1979, Wilkinson and Shank 1976), although this remains a topic of debate. It is likely that differences in habitat use and food selection also minimize competition with moose.

Limitation of population growth through intra-specific competition for food does not appear to be a significant factor for caribou, at the present population size. In an analysis of rates of increase from 19 different caribou herds, Bergerud (1980) found no significant correlation between density of caribou and rates of increase, and felt that food limitation for most herds occurred at densities much higher than the limitation resulting from predation and dispersion. Simulations designed to determine limits to population growth by density dependent food supplies suggest maximum densities of 5-13.5 caribou/km$^2$. The few reported density dependent, food related population declines have occurred on islands at caribou densities of 19 caribou/km$^2$ (Klein 1968, Scheffer 1951), and in the Western Greenland herd (Roby 1980). These declines occurred in the absence of predators. Skoog (1968), in studies on Alaskan caribou, suggested that at certain densities (e.g., 5 caribou/km$^2$), herds may shift their distribution and utilize other ranges before range deterioration results in direct mortality. At the present time the Bathurst herd is at a density of approximately 2 caribou/km$^2$ over the entire range.

## Weather

Weather influences plant growth, alters forage availability through snowcover, affects biting insect abundance, influences range susceptibility to fire, causes fire, and directly affects the energy balance of caribou. No data exist to suggest that weather has been a significant or direct cause of mortality on the Bathurst range. Some mortality of calves has been attributed to severe weather on the calving grounds, but the impact of this is thought to be minimal (Kelsall 1968).

## Fire

Fire is a significant factor affecting the distribution of plant species and succession of the forests on the Bathurst caribou range (Johnson and Rowe 1975). Fire has influenced the distribution and movement of the Beverly herd (Thomas 1985) and may have a similar effect on the Bathurst herd (Jacobson 1979). Forest fires on the Bathurst range result in 40-60 years in which terrestrial lichen species, that are important components of caribou winter diets, are not available. (Thomas and Hervieux 1984, Thomas et al. 1984). Optimum forest age, in terms of productivity of lichens favoured by caribou, has been found to be 75 - 125 years post-fire. The greatest use by caribou is in forest stands 150 - 250 years old.

Although these figures provide a general indication of lichen recovery rates, caution should be taken in extrapolating them to all of the Bathurst winter range. A theoretical comparison of burn rates, assuming that forests 0 - 50 years old are unproductive (Thomas 1985), suggests that the optimum burn rate (the rate required to maintain over half the forested range in its most productive state) is between 0% and 1% per year (Table 4). Thomas (1985) observed that caribou tended to winter in areas with "low" (<0.5%) to "moderate" (0.5%-1% annually) burn rates, except where burns were closely interspersed with productive habitat.

Studies of burn history and caribou population trends suggest that fire has had no detectable effect on caribou productivity (Miller 1976, Thomas 1981, Bergerud 1983). Miller (1980) estimated that the present burn rate would have to increase by a factor of 10 in order to reduce lichen stocks to the extent that caribou might be affected. As well, there is no evidence yet to suggest that burn rates today are any greater than they were before man became part of this ecosystem.

Through their influence on range quality, and thereby caribou distribution, forest fires may affect the availability of caribou to some of the users. The significance of this is not known because winter movements are unpredictable and in some years the Bathurst herd winters almost entirely on the tundra portion of its range (e.g., 1985/86). However, as caribou will generally avoid burns less than 15 years old (Thomas 1985), they may be deflected away from communities. Thus, the primary reason for implementing fire control at present would be to allow for economical access to the caribou by resource users.

## Summary

Although the 1990 population estimate is lower than the previous estimate, the difference is not statistically significant.

Table 4. Theoretical relationship between productive, forested caribou winter range and annual average burn rate (from Thomas 1985).

| Burn rate (% annual average) | 0.25 | .50 | .75 | 1.00 | 1.50 | 2.00 |
|---|---|---|---|---|---|---|
| Interval between fires (years) | 400 | 200 | 133 | 100 | 66 | 50 |
| Productive range (% of total) | 88 | 75 | 62 | 50 | 25 | 0 |

The Bathurst caribou herd is in very good condition. Recruitment has been high for several years and hunter kill has been relatively low. The high recruitment may be a reflection of high birth rates, breeding at an earlier age, low predation, low incidence of disease and parasites, and moderate weather conditions.

## USERS

### Hunting Regulations

The Government of the Northwest Territories (GNWT) is responsible for wildlife management in the Northwest Territories. This mandate is derived from Section 14 of the *Northwest Territories Act* (R.S.C. 1985, c.N-27) This Section also authorizes the GNWT to pass legislation regarding the preservation of game in the Northwest Territories. Under this section the GNWT has passed the *Wildlife Act* (R.S.N.W.T. 1988, c.W-4) which establishes the rules of wildlife use. It gives the Commissioner the authority to make regulations concerning hunting, use and possession of wildlife, licensing, serving of meat, as well as other matters concerning wildlife and wildlife habitat. These regulations are referred to in general as the *Wildlife Regulations*.

Under section 14(3) of the *Northwest Territories Act*, no restrictions can be placed on "Indians" or "Eskimos" hunting for food on unoccupied crown land, except of game declared "in danger of becoming extinct". Barren-ground caribou fall into this category as they were declared "in danger of becoming extinct" in 1960. However, since that time no restrictions have been placed on the harvest of Bathurst caribou by "Indians" or "Eskimos" for food.

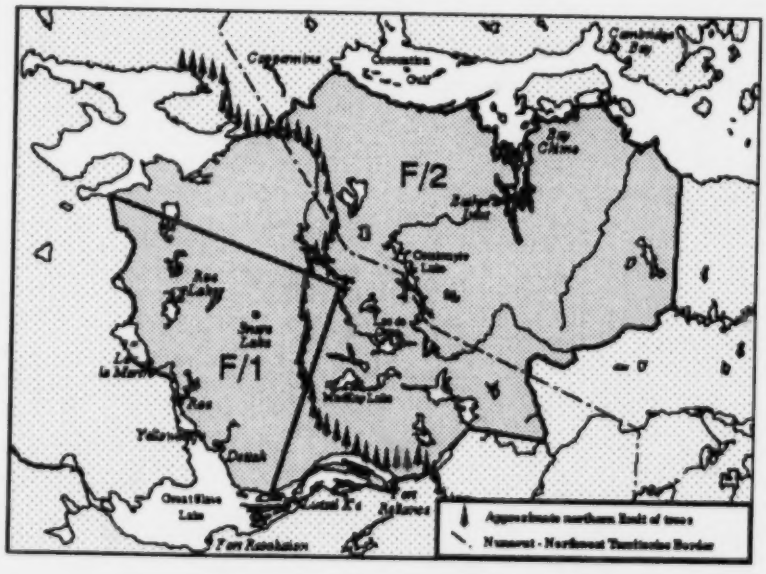
The following sections summarize the regulations concerning the hunting of Bathurst caribou as set out in the *Wildlife Act* and the *Wildlife Regulations*.

- *Hunting Licences*: The *Wildlife Act* defines four types of hunters in the Northwest Territories. General Hunting Licence holders (GHLs) are primarily native hunters who were eligible to receive such a licence under the *Game Ordinance* (R.O.N.W.T. 1974, c.G-1), or are a descendant of a person eligible to hold a GHL. Resident hunters are Canadians or landed

immigrants who have lived in the NWT for at least two consecutive years. Non-resident hunters are Canadians or landed immigrants who have lived in the NWT for less than two years or who live outside the NWT. Non-resident aliens normally reside outside Canada.

- *Wildlife Management Units/Zones:* The majority of the Bathurst caribou range falls within Wildlife Management Unit F. This unit is divided into two zones; F/1 and F/2 (Fig. 5).
- *Calibre of Weapon:* North of the treeline cartridges of .222, .22-250, and .223 calibre may be used, while in treed areas .23 calibre or larger are required.
- *Use of Aircraft:* Anyone travelling by aircraft must wait twelve hours before hunting in Wildlife Management Unit F.
- *Dog Food:* Caribou that is fit for human consumption may be fed to dogs only when they are being used for transportation and when they are at least 8 km from a municipality or settlement.
- *Outfitting:* Non-resident and non-resident alien hunters must organize their hunts through a class B outfitter, and must be accompanied by a licensed class B guide while hunting. Only 17 class B outfitters are permitted on the Bathurst range, 10 of which can be operated by HTAs and the remaining 7 by non-HTA organizations or companies. In 1994, eight class B outfitters operated on the Bathurst range, only one of which was an HTA. As of 1992 a maximum of 660 non-resident tags are available to HTA outfitters, while an additional 660 tags may be issued to non-HTA outfitters. These quotas will apply until 1997.
- *Seasons:* The hunting season for GHL holders extends from 1 July to 30 June. The resident hunting season is 15 August to 30 April. Non-residents and non-resident aliens may hunt between 15 August and 30 November.

Figure 5. Wildlife Management Zones on the Bathurst caribou range.



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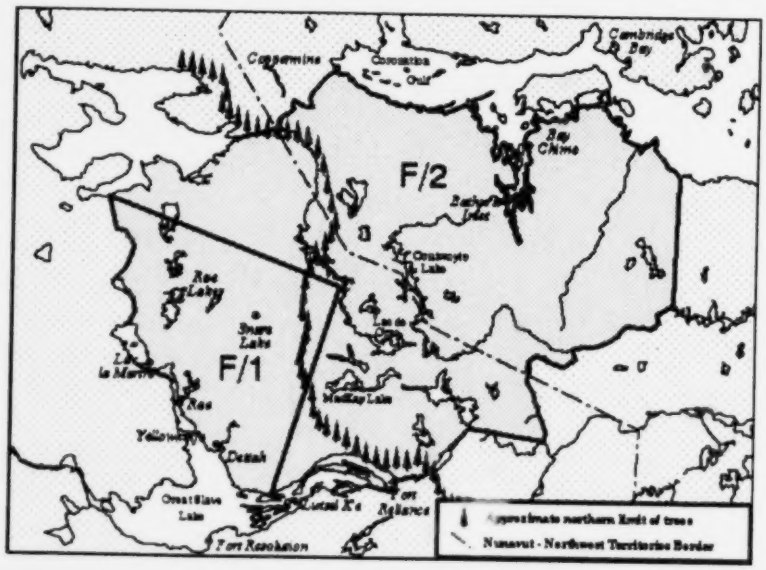


- *Bag Limits:* There is no bag limit for GHL holders. Residents are permitted up to 5 caribou of any age or sex (less the number of barren-ground caribou taken from other herds), while non-residents and non-resident aliens may harvest males only, in accordance with the number of tags held.
- *Fees:* There are no tag or trophy fees for GHL holders. Residents are required to pay $5.00 per tag. The tag fee for non-residents is $10.00 for the first tag and $20.00 for each additional tag. Non-resident alien tag fees are $25.00 for the first tag and $50.00 for each additional tag. A trophy fee of $100.00 must also be paid for each animal exported by non-residents and non-resident aliens. The federal Goods and Services Tax of 7% will be added to the above fees.
- *Disposition of Meat:* GHL holders are only permitted to sell, trade, or barter the meat of caribou with another GHL holder, except if the caribou was taken under the authority of a commercial tag. In the latter case the meat may be sold, traded or bartered to anyone within the Northwest Territories. Any person may receive a gift of meat from a GHL holder of up to 10 kg, over any sixty day period. Resident hunters may not sell, trade, or barter the meat of caribou, but may make or receive a gift of meat, provided a receipt to record the exchange is issued. A resident may obtain a licence to deal in the meat of game, but may only sell caribou harvested under the authority of a commercial tag. Non-resident and non-resident alien hunters may not sell, trade, or barter the meat of barren-ground caribou they harvest. They may, however, make a gift of meat to either a GHL holder, or the holder of a licence to deal in the meat of game.
- *Export:* A GHL holder may only export up to 50 kg of meat in any one year. Resident, non-resident, and non-resident alien hunters may export any meat lawfully harvested by them under the authority of their licence and tags. An export permit is required for all Bathurst caribou meat taken out of the Northwest Territories.

Under the Northwest Territories *Area Development Act* (R.S.N.W.T. 1988, c.A-8) the Department of Municipal and Community Affairs has established two no shooting zones along the Ingraham Trail east of Yellowknife. These regulations prohibit the discharge of a firearm from the centre of the Ingraham Trail 1.5 km into the bush on both sides of the highway. The first zone begins at the City of Yellowknife boundary and extends to Prelude Lake East. The second zone begins at Pickerel Lake and extends to the eastern end of the Ingraham Trail at Tibbet Lake.

## Harvesters

The Bathurst herd is harvested by all four categories of hunters; GHL holders, resident hunters, non-resident hunters, and non-resident alien hunters. GHL holders make up the bulk of the hunting population, with over 7700 GHL holders in the communities which hunt Bathurst caribou (NWT Dept. of Renewable Resources files). This may be an underestimate of the number of hunters, as some hunters who are eligible for a GHL have not applied for one, while hunters under the age of sixteen are

not yet eligible for a GHL, but are permitted to hunt under the authority of their parent's GHL.

Resident hunters make up the next largest group, with around 1000 caribou hunters in the communities on or around the Bathurst range in the early 1990s.

Non-resident and non-resident alien hunters make up a small, but increasing, portion of the harvesters with 360 hunters in 1993.

General Hunting Licence Holders

The limited information available on harvesting by GHL holders indicates that GHL holders in communities around the Bathurst range harvest up to 16,800 caribou per year. Many of these hunters also have access to caribou from the Bluenose, Beverly, Victoria Island, or Northeast Mainland herds, or to woodland caribou. Thus, some of the reported harvest may not come from the Bathurst herd. Part of this difference would likely be made up by additional losses due to wounding.

GHL holders are permitted to harvest unlimited numbers of caribou of any age or sex, and can hunt throughout the year. This permits people to meet their needs whenever caribou are available. In general, use of the Bathurst caribou herd is strongly influenced by their seasonal availability.

The historic western limit of Bathurst caribou, the Mackenzie River, has not been reached in recent years (Urquhart 1981). This has reduced harvest opportunities for the communities of Fort Norman, Fort Franklin, and Wrigley. Thus, some Hunters' and Trappers' Associations organize hunts, often using fixed-wing aircraft, in order to reach caribou.

The winter road to the Lupin Mine on Contwoyto Lake is particularly important for hunter access. Hunters from Fort Rae and Edzo, Yellowknife and Detah, Lac la Martre, Fort Smith, Hay River, Fort Resolution, Fort Providence, Fort Liard, and Fort Simpson have regularly used this road (NWT Dept. of Renewable Resources files).

Results from the Kitikmeot Harvest Study indicate that for Coppermine and Bay Chimo in 1988-89 the sex ratio of the harvest was 122 males: 100 females (Jingfors 1984). In the Gordon Lake area between 1979/80 and 1984/85, GHL and resident hunters harvested 370 males: 100 females (NWT Dept. of Renewable Resources files). The difference between these figures likely reflects availability, not hunter preference. Gordon Lake is located at the southern extent of the winter range, resulting in a greater availability of males than at Coppermine and Bay Chimo, which are closer to the calving ground.

Hunting of Bathurst caribou by GHL holders typically has three peaks. In mid-summer, when the herd is on the tundra at the northern end of its range, the Inuit hunters from Coppermine, Bay Chimo, and Cambridge Bay harvest the herd. In the late fall, just before or just after freeze-up, the Dogrib communities north of Great Slave Lake conduct organized hunts as the caribou move onto the winter range. In mid to late winter, communities on the highway system harvest the herd from winter roads.

The value of the harvest, in purely economic terms, can be calculated using an average of 45 kg of meat per animal and a replacement cost of $14.00 per kg (approximate price of beef in smaller communities). Using these figures, the harvest by GHL holders has a value of $10.58 million per year (16,800 x 45 x $14.00), not including the spinoff benefits to stores which sell equipment for hunting.

The value of the harvest in social and cultural terms is not so easy to quantify. This value cannot be fully evaluated using traditional economic analysis, as the caribou confer considerable benefits and strengths upon life in the communities.

Resident Hunters

Resident hunters account for approximately 10% of the Bathurst caribou hunters. The resident harvest has remained between 1500 and 2000 caribou since 1987 when the quota was set at 5 caribou per resident hunter (Table 5). The majority (about 80%) of resident hunters are from Yellowknife. The number of hunters and the size of the harvest vary greatly among years depending on the proximity of the caribou to winter roads. For example, the high harvests recorded in 1987/88 and 1990/91 (Table 5) resulted when large numbers of caribou wintered in the Gordon Lake area. Residents from south of Great Slave Lake also hunt Bathurst caribou, especially when they are accessible along the Lupin or Lac La Martre winter roads.

Residents are permitted to harvest up to 5 barren-ground caribou per year. The quota was set at 5 tags for 5 dollars until 1982, when it was reduced to 2 tags only, with 5 year residents being allowed to purchase a third tag. The residency requirement for the third tag was lifted in 1986 and the tag fee for each tag was set at 5 dollars. In 1987 the quota was returned to 5 tags, but each costing 5 dollars.

The season for resident caribou hunting on the Bathurst range extends from 15 August to 30 April; however, hunting by residents is concentrated during two time periods. Early in the fall (Aug/Sept),

Table 5. Resident hunter harvest of Bathurst Caribou 1981/82 - 1994/95.

| Year | Number of Hunters[a] | Estimated Harvest[b] |
|---|---|---|
| 1981/82 | 467 | 250 |
| 1982/83 | 567 | 389 |
| 1983/84 | 696 | 924 |
| 1984/85 | 706 | 348 |
| 1985/86 | 602 | 432 |
| 1986/87 | 778 | 1065 |
| 1987/88 | 990 | 1905 |
| 1988/89 | 1011 | 1437 |
| 1989/90 | - | 1547 |
| 1990/91 | 1094 | 2004 |
| 1991/92 | 987 | 1469 |
| 1992/93 | 1040 | 2143 |
| 1993/94 | 1010 | 1238 |
| 1994/95 | 926 | 1668 |

[a] Number of hunters who purchased caribou tags in communities adjacent to the Bathurst caribou range

[b] From hunter harvest questionnaire returns.

hunters fly north of the treeline and harvest caribou during their fall migration. Hunting activity decreases during freeze-up, then increases again once the ice roads have been constructed in late December or early January.

The sex ratio of the resident harvest is weighted towards males, with an average of 193 males: 100 females being taken between 1985-86 and 1988-89 (NWT Dept. of Renewable Resources files). This reflects the fact that much of the harvest occurs on the southern edge of the winter range where males

tend to predominate, and the fact that trophy bulls are often selected in the fall.

The value of the harvest to residents is more accurately represented by the economic value, as much of the harvest is used as an alternative to commercially available meat. However, there is still an unquantified social and personal value in the hunt.

Using the same figures as for GHL holders, the resident harvest has an average value of $648,900 (1030 x 45 x $14.00). This harvest also provides spin-off benefits to air charter companies, stores selling hunting and camping equipment, snowmobile dealers, and outfitters, among others.

Non-Resident and Non-Resident Alien Hunters

The existing system for outfitting non-resident and non-resident alien hunters on the Bathurst range was started in 1982. In the few first years very few animals were taken; however, the harvest has increased substantially since, with over 500 caribou being harvested in 1993 (Table 6).

This trend is likely to continue, provided this recreational activity is properly marketed and developed. Discussions with non-resident alien hunters suggest that the establishment of a new trophy category for "Central Canada Barren-ground Caribou" (Boone and Crockett Club 1984), has contributed to increased demand for hunting opportunities on the Bathurst caribou range. Existing quotas will allow for up to 1320 caribou to be taken by non-resident or non-resident alien hunters.

Although the total number of caribou harvested by these hunters is only a small fraction of the total annual harvest (about 2%), the economic value of this industry is substantial. The guided hunts undertaken by this group generate from $2,000 - $5,000 per hunter in outfitter, license and trophy fees. In addition, secondary expenditures in conjunction with travel, lodging, and other recreational activities while in the NWT, generate considerable income. Assuming a minimum total expenditure of $3,000 per hunter, the 360 hunters in 1993 injected $1.08 million into the NWT economy.

Table 6. Harvest of Bathurst Caribou by non-resident and non-resident alien hunters from 1982 - 1995.

| Year | Caribou tags available | Caribou Harvested |
|---|---|---|
| 1982 | 80 | 2 |
| 1983 | 80 | 14 |
| 1984 | 80 | 24 |
| 1985 | 96 | 57 |
| 1986 | 200 | 67 |
| 1987 | 400 | 165 |
| 1988 | 800 | 291 |
| 1989 | 800 | 349 |
| 1990 | 800 | 227 |
| 1991 | 1010 | 180 |
| 1992 | 1320 | 343 |
| 1993 | 1320 | 517 |
| 1994 | 1320 | 409 |
| 1995 | 1320 | 574 |

Commercial Hunting

Caribou from the Bathurst herd may also be

hunted for commercial resale of meat. The first commercial quotas were established in August 1969. They were assigned on the basis of Game Management Zones rather than by herd. The total commercial quota in former Wildlife Management Zones 1, 17, and 27 (primarily Bathurst range) was 2,800 caribou, or approximately 2% of the 1970 population estimate of 150,000. Only 71 animals were sold under this quota in 1970/71, though data for Coppermine and the Bathurst Inlet area were not reported (Urquhart 1981).

In 1979 the quota was reduced to 1,300 caribou for Zones 1, 17, and 27, 1% of the 1978 population estimate of 127,000 animals. When the *Wildlife Act* was passed in 1979, commercial caribou quotas were assigned on a herd-by-herd basis. No commercial quota was assigned to the Bathurst herd until 1984, when a commercial quota of 100 Bathurst animals was made available. This was commonly referred to as the "special events quota" since it was designed to allow caribou to be served at special functions, and was allocated based on the merits of each application. In 1986 the commercial quota for the Bathurst herd was increased to 650 and the "special function" restriction was removed. In 1988 the quota was again increased to 750 to provide at least 100 tags to each of Cambridge Bay and Coppermine. The number of tags available for commercial sale of meat was increased to 1320 in 1992.

Commercial tags are allocated to HTAs, which then sub-allocate them to member GHL holders or conduct an organized commercial harvest. In both cases the harvesting is done by GHL holders. Meat harvested under this quota is expected to be primarily used for resale through country food outlets, intersettlement trade, resale in northern restaurants, and supplying schools, hospitals and other institutions with caribou meat. However, when federal inspection can be arranged the meat can be exported from the Northwest Territories.

If the current commercial quota were filled, and the meat sold at the current price of approximately $14.00 per kg, the total revenue would be $831,600 (1320 x 45 x $14.00). Additional revenue could be generated from the sale of hides, antlers, and handicrafts made from hides and antlers.

Commercial tags designated for the Bathurst herd may not be used for non-resident or non-resident alien hunting. A separate quota has been established for that purpose. However, Hunters' and Trappers' Associations have the option of switching tags between the two quota types in order to maximize the benefits. The HTA must make this request by April 1 in order to have the change in effect on July 1.

## Non-consumptive Users

Bathurst caribou are also important to people who enjoy observing, studying, and photographing wildlife. Reports from the Gordon Lake Check Station and Renewable Resource Officers indicate that the road is used every year by sightseers and photographers. On the Bathurst caribou range there are three facilities which cater to non-consumptive users. The Bathurst Inlet Naturalist Lodge, located on Bathurst Inlet, has been in operation for over 20 years. It can accommodate a maximum of 120 people during its 6 week annual season.

Facilities at Courageous Lake and MacKay Lake, 250 km northeast of Yellowknife, also provide opportunities for non-consumptive users. Discussions with participants in naturalist programs indicate

potential for substantial growth. Users of these facilities are also likely to spend close to $3,000 each during their visits to the NWT.

## DEVELOPMENT

### Land Use Regulations

While the Department of Renewable Resources is the primary authority for the management of the Bathurst caribou herd itself, Indian and Northern Affairs Canada (INAC; formerly Department of Indian Affairs and Northern Development - DIAND) retains the primary authority for land management. Most land use activities are regulated under the *Territorial Land Use Regulations*, while other Territorial and Federal regulations address use of specific areas. The following is a brief overview of these regulations.

- *Territorial Land Use Regulations:* These regulations are set under the authority of the *Territorial Lands Act* (R.S.C. 1985, c.T-7), are administered by INAC and apply to all Territorial Lands; i.e., all lands not privately owned or controlled by the NWT Government. The regulations require that a Land Use Permit be obtained for a wide variety of activities including use of explosives, use of heavy off-road vehicles, drilling, large campsites, fuel caching, earthmoving and clearing. The Department of Renewable Resources reviews permit applications and provides advice to INAC concerning conditions which should be part of the permit. These conditions are designed to help mitigate potential environmental impacts.

- *Critical Wildlife Areas Regulations:* The core area of the Bathurst calving grounds has been designated as Critical Wildlife Area Number 4. The defined area does not reflect the distribution of calving caribou in recent years. No regulations currently apply to the area; however, there is a provision in the *Wildlife Act* for the Commissioner to make regulations "... respecting wildlife management... including the regulation or prohibition of access...". The intention of the Critical Wildlife Areas designation is to ensure that the GNWT has the capability to manage important wildlife areas in order to protect their special values. Although the Federal Government owns the land, Territorial legislation may be applied to protect wildlife and wildlife habitat. It is, therefore, possible to regulate activities within Critical Wildlife or Special Management Areas. Either of these designations could be used as a means of protecting Bathurst caribou and their habitats.

- *Migratory Bird Sanctuaries Regulations:* These federal regulations are administered by the Canadian Wildlife Service (CWS). Part of the Queen Maud Gulf Migratory Bird Sanctuary is located on the Bathurst caribou range, and almost entirely encompasses the Bathurst calving ground Critical Wildlife Area. The *Migratory Bird Sanctuary Regulations* state that, in this area, no person shall "... carry on any activity that is harmful to migratory birds or the eggs, nests or habitat of migratory birds, except under authority of a permit.". Although these regulations are directed to migratory birds, the proposed amendments to the *Canada Wildlife*

*Act* (R.S.C. 1985, c.W-9) will enable Migratory Bird Sanctuaries to be used to protect the habitat of other species such as caribou.

## Industrial Development

Industrial activities on the Bathurst range include operating mine sites, mineral exploration camps, winter access roads, and air strips. Associated with these facilities are considerable movement of vehicles, aircraft and people, noise from these movements and related operations, and discharge of mining wastes into tailings areas. Airborne pollutants from industrial and non-industrial sources outside the NWT also affect the range.

There are several operating mines on the Bathurst range. The Lupin mine on Contwoyto Lake is on the summer range of the herd. There are also three operating mines on the winter range; in the Yellowknife area. The Colomac Mine near Indin Lake was reopened in 1994. Salmita Mine near Mackay Lake was shut down in January 1987, but exploration is continuing in the area. The Terra Mine, near Great Bear Lake, and the Bull Moose Mine, southeast of Yellowknife, have been dismantled. Access to the Lupin and Colomac mines is mainly by aircraft with road access from mid-to late winter.

Gold has also been discovered in the Courageous Lake area, while substantial deposits of lead, zinc, and silver have been delineated at Izok Lake. Several diamondiferous kimberlite pipes have recently been discovered near Lac de Gras and Yamba Lake. This has resulted in extensive drilling and bulk sampling operations. The largest operation, north of Lac de Gras, involves a 180 man camp, a processing plant, an airstrip, drilling through the ice, several kilometers of all weather roads and two underground ramps.

Mineral exploration activities have been conducted at a number of locations on the Bathurst range during the past 10 years. Work has included diamond drilling, mapping, and a variety of reconnaissance, geophysical, and magnetic surveys.

The only major documented impacts on caribou from development are associated with the winter roads. A substantial percentage of the annual harvest of Bathurst caribou is obtained through access provided by the Lupin winter road and the winter road system running north to Indin Lake. Data from the Hunter Check Station on Gordon Lake between 1979/80 and 1984/85 indicate that an average of 222 (49%) GHL holders and 233 (51%) Resident Hunters used the road annually for caribou hunting. These hunters came from at least ten communities and harvested an average of 1,228 caribou annually (1,020 GHL; 208 Resident). These harvest figures do not include caribou consumed or dried in camp or those wounded and not retrieved. The largest harvest reported for the Lupin winter road was 3,744 caribou in 1983/84 (excluding unrecovered wounded animals and 132 believed to be from the Beverly herd); however, the check station has not operated since 1987.

Winter roads also have the potential to disrupt caribou movements. High volumes of traffic at short intervals may result in caribou refusing to cross the road. Further investigation is required into the effect of traffic and mitigative measures needed.

Individually, most of the potential and proposed developments on the Bathurst range are expected to

have limited impact on the population dynamics of the herd. Each development may result in disturbance or displacement of a portion of the herd so, in order to assess the impacts on the herd properly, development needs to be addressed on a regional and cumulative basis.

Concerns have been expressed regarding the exposure of caribou to mine wastes (tailings) and their subsequent consumption by people. Caribou are known to use the tailings area and airstrip at Lupin as insect relief habitat. The potential for and levels of exposure to tailings need to be investigated further.

There was renewed concern regarding the impact of radioactive fallout following the April 1986 accident at the Chernobyl nuclear power station. However, a study of the radioactivity in caribou indicated that the nuclear accident increased radioactivity in caribou by only 25 percent over background levels recorded during the previous 10 years (Thomas et al. 1992). Recent studies by the Department of Renewable Resources have found that radioactivity levels in caribou have fallen since 1988 (Elkin and Bethke 1995). The levels of radioactivity found in caribou in the NWT are considered safe for human consumption by international standards (Crête et al. 1987). The monitoring of radioactivity levels is continuing.

In Canada, few studies have been conducted to relate acid rain to plant damage, and none of these has involved tundra vegetation (Shewchuk 1983, Rubec 1981). Rubec (1981) indicated that most of the Bathurst range, and especially the winter range, would be expected to have a high sensitivity to acidic precipitation, as the soils are poorly buffered. It is likely, therefore, that the lichen vegetation could be affected by even low annual input of slightly acidic precipitation.

In addition to the direct effects on plants and soil, acid precipitation may indirectly affect caribou through the reduction of selenium in forage species (Shewchuck 1983), although no studies have been conducted to confirm this. Insufficient selenium results in a degeneration of muscle tissue or "nutritional myopathy" in some captive mammals and may do the same in caribou.

## Recreational Opportunities

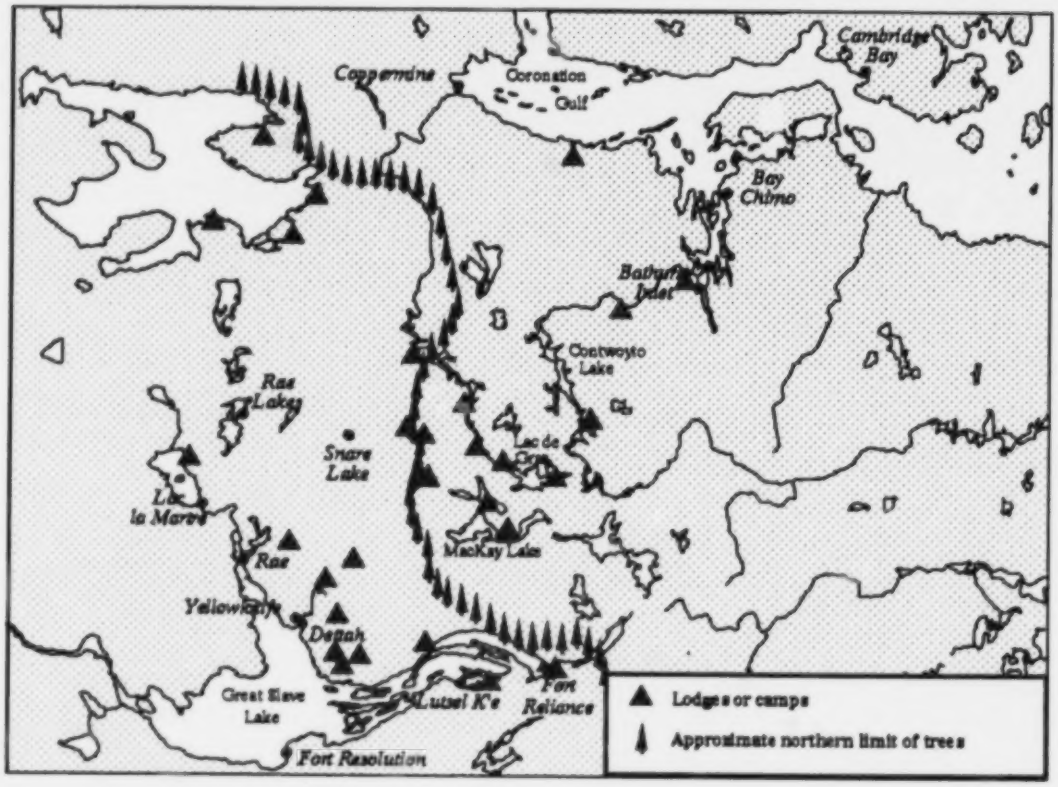
Several lodges or camps, catering to hunters, fishermen, and naturalists are located on the Bathurst range (Fig. 6). These facilities can include a few permanent buildings or simply frame tents. Most are accessed by float plane and are centred around guided trips on land, water, and in the air. Trips usually involve small groups of less than ten people and are restricted to the summer months.

Two National Parks had been proposed on the Bathurst caribou range. The Bathurst Inlet area was first identified as a potential park in 1978 (Canada, Parks Canada 1978) (Fig. 6), however, the proposal has since been withdrawn.

The East Arm of Great Slave Lake (Fig. 6) has been withdrawn under the authority of the *Territorial Lands Act* since 1970, thus preventing the use of the land for purposes which may reduce the potential value of the area as a National Park (Canada, Parks Canada 1985).

Recreational activities on the Bathurst range have likely resulted in some disturbance to various segments of the herd; however, the impact on the Bathurst herd at current levels of tourism are not believed to be significant.

Figure 6. Recreational developments on the Bathurst caribou range.



# MANAGEMENT

## Management Principles

The principles which have guided the management of the Bathurst herd during the past ten years are as follows:

1. The Government of the Northwest Territories recognizes its mandate to administer, manage, and allocate access to barren-ground caribou in cooperation with users.
2. The Government of the Northwest Territories recognizes the dependence of traditional users on caribou for food as well as the social and cultural importance of caribou. It is further recognized that the residents of the NWT are the primary beneficiaries of the resource and that communities on, or bordering on, the Bathurst caribou herd range have a particular dependence on caribou from this herd.

## Management Goals Objecives and Strategies

The goals for the management of the Bathurst caribou herd have been identified as follows:

1. To safeguard the Bathurst caribou herd so that traditional users can maintain their option of a lifestyle which includes the use of caribou.
2. To safeguard the Bathurst caribou herd in the interest of Northwest Territories residents, all Canadians, as well as people of other nations.

In order to pursue these goals, a number of objectives were identified. This section describes, in detail, the strategies proposed to attain each of the objectives.

**Objective 1:** To maintain the Bathurst caribou herd at a population level high enough to sustain a harvest of at least 16,000 caribou, yet not so high as to threaten the productivity of the herd or the range.

A population of between 300,000 and 600,000 caribou in the Bathurst herd has been identified as the range which will meet this objective. The limited information available on the ecosystem in which the herd occurs indicates that a population of 600,000 animals could be sustained without damage to the caribou range. A population of 300,000 is sufficient to provide for current demand as well as a slight increase in use.

The upper limit of 600,000 is recognized as being conservative, and could be increased with further information on the ecosystem or by a significant increase in the size of the herd's range. Thus, if the calving ground surveys indicate that the herd is larger than 600,000 animals, studies will be undertaken to determine whether there have been changes in caribou condition, pregnancy rates, calving dates, neonate mortality or neonate size. If these studies indicate that the herd is exceeding the capacity of their range, the herd may have to be culled to a level which can be sustained. In any culling operations Dene/Metis and Inuit organizations will have the first opportunity to conduct the hunt, in their respective areas, and to use or sell the wildlife parts and products resulting from the hunt.

The lower limit of 300,000 will permit a harvest of up to 16,000 caribou by traditional users, plus a resident harvest of 1000 caribou and a commercial harvest. Should the calving ground surveys indicate that the herd has declined to below 300,000 animals, studies will be undertaken to determine causes and rates of calf and adult mortality. Precise harvest

information from all users will be essential for determining any corrective measures. Depending on the causes identified, management actions such as negotiated harvest restrictions, predator control programs and protection of the herd during critical periods will be considered.

The present size of the Bathurst herd (352,000 in 1990) is within the "optimum" range; therefore, no changes to the current management actions are required at this time.

**Objective 2:** To ensure that caribou are accessible and available to traditional users.

Bathurst caribou are generally accessible to communities on the tundra throughout the year, although they occur at lower densities during the winter. The accessibility of caribou to the southern communities varies among and within years depending upon winter distribution and movements. The reasons for this variation are not understood, but are likely related to a combination of weather, snow conditions, physical condition of the caribou, herd size, habitat quality, and/or man-caused disturbance. Little can be done to influence the first three factors, but the Department will endeavour to manage the latter three factors.

This will be accomplished by:

(a) Maintaining the herd within the range of 300,000 to 600,000 caribou, as described in Objective 1. It is generally agreed that a larger herd will utilize more of the winter range, and, therefore, will likely be accessible to more hunters.

(b) Mapping and monitoring areas of the range lost to fire and identifying areas where further loss of range could result in a barrier to caribou movements on the winter range.

(c) Monitoring and mitigation of the effects of human activities on caribou distribution. Increased human activity on the Bathurst range associated with mineral exploration and development, and with recreational developments has the potential to affect caribou distribution and movements. Very high volumes of traffic along winter or all weather roads may result in interruption or deflection of migration.

**Objective 3:** To identify the total allowable harvest from the herd and provide for an equitable allocation of the harvest.

The total allowable harvest is defined as the number of caribou which could be harvested from the herd while meeting the management objective for the herd, i.e., increasing, maintaining, or decreasing herd size. The total allowable harvest will be determined every five years and will be based on recruitment, population size, and harvest data collected during the intervening years. Using computer simulation models, the Department is able to incorporate data on recruitment, sex ratios, age of first reproduction, the proportion of females producing calves, hunter selection by sex and age, estimates of wounding, and natural mortality into an estimate of what can be harvested from the herd.

The total allowable harvest, based on current information and the 1990 population estimate, is approximately 23,000 caribou. At this harvest level the herd should remain at or above 350,000 caribou. This assumes that the high recruitment levels observed since 1984 will continue, that existing estimates of natural mortality are realistic, and that the little information available on the sex ratio of the

hunter kill and wounding rates is accurate.

With all the assumptions that have to be made in calculating the total allowable harvest, it is necessary to be conservative when specifying harvest levels. It is possible that the herd could withstand a harvest above 23,000, but it is also possible that a harvest of 23,000 could have a larger impact on the herd than predicted. Thus, it is recommended that the harvest not exceed 20,000 animals. As more information becomes available, the calculation of total allowable harvest will become more accurate and thus could be less conservative.

Once the total allowable harvest has been estimated, it must be allocated in an equitable manner, recognizing the various land claims settlements for the users of this herd.

Given the relatively small harvest by resident, outfitting, and commercial meat harvesters, the Department does not anticipate any restrictions on the current allocations unless the viability of the Bathurst herd is threatened by this activity.

In order to ensure that outfitting and commercial meat quotas are not susceptible to minor fluctuations in herd size, productivity, and other harvest activities the Department has:

a) established an upper limit on commercial quotas of 0.75% of the total population,
b) set the commercial quotas for a period of five (5) years starting with the year following a population estimate, and
c) considered requests for commercial quota increases in the intervening years only if the existing quotas are less than 0.75% of the total population.

**Objective 4:** To increase knowledge of caribou ecology and management.

The ongoing management of the herd requires a minimum level of monitoring including:

a) Determining the size of the herd using photographic surveys of the calving grounds every six years. A survey was conducted in 1990 and the next survey is scheduled for 1996.
b) Determining recruitment rates annually to provide data on whether to expect an increase or decrease in herd size.
c) Determining the size, characteristics and impact of the annual harvest. This includes information on the number, age, sex, date, and location of caribou harvested by all user groups.
d) Mapping the range lost annually to fire.

Management can be refined with additional information on the ecology of the herd including:

a) The nature and magnitude of natural mortality of Bathurst caribou, particularly with regard to wolf predation.
b) The extent and causes of exchange of animals between the Bathurst and neighbouring herds.
c) The proportion of males and females of various age classes in the herd.
d) The source and impact of pollutants on Bathurst caribou and their habitat, including expanded monitoring for possible contaminants (e.g., pesticides and radionuclides such as cesium).
e) Nutritional status of the herd as indicated by biochemical indicators, body composition, and foraging behavior.
f) The status of parasites and disease and their relationship to herd nutritional status, physical condition, and density.
g) The timing and location of insect harassment,

particularly warble and bot flies, and its affect on the physical condition of the animals.

h) The importance of various habitat components, such as calving grounds, eskers, and lichen to herd distribution, movement, and productivity and the current status of these components.

i) The influence of fire on herd distribution, movement, habitat quality, and hunter access.

j) The relationship between weather conditions, primarily winter weather, and herd ecology.

**Objective 5:** To encourage the wise use of caribou.

This objective is primarily to eliminate wastage. Wastage may occur because a hunter's needs are actually less than the number shot, because of an inability to transport all harvested animals, or because of poor hunting, handling, or storage techniques. Wastage also occurs when hunters fail to recover wounded animals. In order to achieve this objective the Department is:

(a) Supporting the construction of community storage facilities.

(b) Developing educational programs which focus on marksmanship, hunting technology and skills (e.g., ballistics, rifle and scope maintenance), butchering, meat cutting and handling, traditional meat processing (such as drying meat), and preparation of food and hides.

(c) Supporting local and regional marksmanship and hunter skills competitions.

(d) Developing guidelines for the distribution of meat from non-resident hunting.

(e) Investigating possible uses for winter caribou hides.

**Objective 6:** To involve the public and wildlife-oriented organizations in research and management programs and to strengthen public support for the conservation of caribou.

The involvement of NWT residents, particularly users of the Bathurst herd, in management programs provides meaningful input and gives relevance to resource management. This involvement also contributes to a sense of stewardship and cooperation among those involved. This objective requires the sharing of information and active solicitation for involvement. In order to achieve this objective, the Department will continue to:

(a) Conduct periodic discussions of research and management programs with the user communities.

(b) Encourage the involvement of the communities in the production of educational material.

(c) Encourage the involvement of local residents in field data collection programs and research projects undertaken by the Department and outside agencies.

(d) Involve communities in decisions regarding the allocation of commercial quotas.

(e) Provide relevant information to the public.

**Objective 7:** To ensure that development activities on or near the Bathurst range do not threaten the distribution, quality or productivity of the herd and its habitat. In order to minimize and assess the impacts of development, the Department will continue to:

(a) Review all applications for Land Use Permits on the Bathurst range and provide recommendations to the land management authorities on how to mitigate any impacts on the herd.

(b) Participate in the environmental review process

for any proposed developments.

(c) Monitor the distribution and movements of caribou in relation to industrial developments.

## SUMMARY OF PUBLIC COMMENTS

The following is a synopsis of comments received during the public consultation undertaken between 1988 and 1993 on the Draft Bathurst Caribou Management Plan. Many of the comments came from several sources while others were received only from one source. Comments received have been taken into account in the management of the Bathurst herd and the preparation of this report.

These comments are included in this report to illustrate some of the responses recieved during past discussions. It is anticipated that many of these comments will be reiterated during future discussions on the management of Bathurst caribou.

◆ There was general support for commercial use of the Bathurst Caribou herd. Meat harvesting and outfitting were both supported in the northern part of the range; however, there was some apprehension about commercial meat harvesting in the southern part of the range.

◆ Several discussions took place on the need for a "Bathurst Caribou Management Board" such as that now in place for the Beverly and Qamanirjuaq herds. The general consensus was that the Denendeh Conservation Board and the Nunavut Wildlife Management Board (and their successors) or subcommittees from these boards could handle the management issues.

◆ HTA outfitters should have priority over non-HTA outfitters and this should be reflected in the quotas.

◆ GHL holders should be required to report their harvest as a demonstration of their commitment to the management of caribou.

◆ The "schools" program currently in use on the ranges of the Beverly and Qamanirjuaq herds should be expanded to include the "Bathurst" communities.

◆ It was suggested that a study be conducted into what can be done with the hides from winter killed caribou so they would not be wasted.

◆ Hunter education and firearm safety should be a requirement for a licence. The program should include information on the ecology of caribou.

◆ Forest fires on the caribou winter range should be fought.

◆ The migration routes of caribou should be protected through fire management.

◆ Tighter control is needed on the disposition of meat from non-resident hunting, and guidelines should be prepared.

◆ The newspaper format is an excellent way to inform hunters of the proposed management guidelines.

◆ The plan should consider low level flights by the military.

◆ Community participation and communication between biologists and hunters is important to management.

◆ Public awareness of management programs is important to gaining support of the public and developing a sense of stewardship for caribou and their habitat.

◆ Greater efforts should be made towards educating hunters on the importance of accurate and complete harvest data.

◆ There needs to be a clearer distinction

between commercial tags used for meat sales and outfitting.

◆ Fifteen years is too long before reviewing the management strategies (10 years would be better).

◆ Additional support is needed to ensure freezers operate properly.

◆ There are several discrepancies between the Dene-Metis Agreement-in-Principle and the draft Bathurst Caribou Management Plan which was released in 1988.

◆ Concern was expressed about large harvests by communities from outside the Bathurst Range.

◆ Wastage needs to be better defined.

◆ There was general support for the Ingraham Trail corridor and some suggestions that it be expanded to include all of Tibbit Lake to protect cabins there.

◆ "Caribou News" format should be used to distribute information about the caribou.

## CONCLUSION

In the process of developing the management section of this report the Department of Renewable Resources found a healthy public interest in the welfare of the Bathurst caribou herd. It became quickly evident that many northerners depend upon the herd for their livelihood and/or recreation and all from whom we received input felt that maintaining the herd's population and distribution was essential to maintaining the unique characteristics of the Northwest Territories as a whole.

In implementing the recommendations from this report it is important to recognize that wildlife populations are highly dynamic and, therefore, management programs must be flexible enough to address unforeseen changes or problems.

Current data available on the ecology of the Bathurst caribou herd suggest that the herd is health and productive; however, there are many factors which may affect the future of the herd, not least of which is human activities.

In summary, it must be recognized by persons or industries using Bathurst caribou, or their habitats, that ultimately the welfare of the herd rests in their hands.

## ACKNOWLEDGEMENTS

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